CHEMICALS

Project Fact Sheet

Oxidation Olefin Reactor

Benefits

- Up to 20% cost reduction
- Elimination of steam, stack losses, and product compressor
- Decreased reactor capital costs
- Reduced CO_2 emissions
- Increased reaction selectivity
- Decreased feedstock and natural gas use

Applications

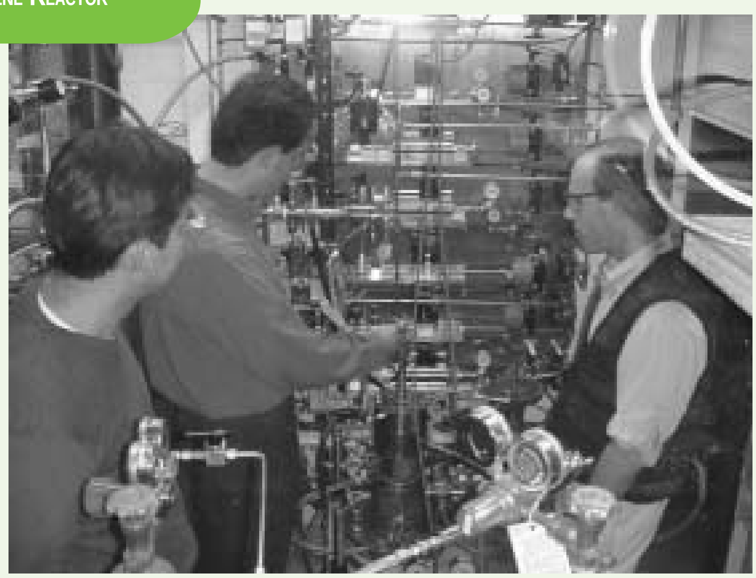
This new technology can be applied to a number of chemical processes across the petrochemical industry, including ethylene production. The proposed technology is also applicable in the production of ethylene and propylene from propane, butane and naptha feedstocks.

Novel Reactor Could Help Modernize U.S. Ethylene Production

Ethylene is the largest volume organic chemical produced in the country, totaling 50 billion pounds per year. Ethylene production is one of the most energy and capital intensive processes in the petrochemical industry and is currently produced by thermal dehydrogenation or cracking of small alkanes. This technology is over fifty years old, has low conversion rates, and uses a complicated ethylene separation and ethane recycle system.

New approaches that use oxidative hydrogenation of hydrocarbons to produce ethylene could outperform the standard industrial method of thermal cracking and reduce energy consumption, capital expenditures, and environmental emissions. This process combines the use of BP's short reaction time catalyst and process knowledge with Praxair's gas mixing technology to provide a novel oxidative dehydrogenation reactor. This process does not require external heat at high temperature as does the conventional steam cracking technology. Commercialization will bring about a dramatic reduction in energy consumption and production costs for ethylene manufacture and other similar cracking reactions, including ethylene and propylene from propane, butane, and naptha feedstocks.

Ethylene Reactor



Bench-scale oxidative ethylene reactor provides data on innovative approach to olefins production.

Project Description

Goal: To develop an advanced process to produce ethylene by oxidative dehydrogenation of hydrocarbons that will have significant energy savings and lower production cost.

Ceramic monoliths impregnated with metals or metal oxides have shown significant promise in the laboratory with selectivities approaching or exceeding those of the commercial process. Selectivities have been especially impressive when hydrogen is co-fed with the ethane and oxygen. In economic terms, a disadvantage of the short contact time oxidative route to ethylene is the fact that oxygen and not air is used, and that part of the hydrocarbon feedstock is burned rather than a fuel value stream as in steam cracking technology—this disadvantage being particularly relevant to expensive feedstocks such as naphtha. This disadvantage can be minimized by maximizing the preheat levels to the short contact time process and by co-feeding hydrogen. Further, introducing oxygen into a hydrogen hydrocarbon mixture presents significant technical challenges. A solution has been identified by using Praxair's unique reactor system that in the laboratory has been very successful in combining safe and effective oxygen/ethane mixing with short contact time catalytic monoliths and has the unique capability to operate at high preheat levels with ethane and naphtha feedstocks.

Progress & Milestones

BP and Praxair have been active in this technology for a number of years and have obtained several patents. Project partners are currently conducting the parametric investigation of the reactor components.

Future research will focus on achieving the following milestones:

- Thermal nozzle, mixing chamber and catalyst modeling
- Thermal nozzle and mixing chamber scale-up
- Parametric investigation of reactor components with alternate feedstocks
- Conceptual process design and economic assessment
- Semi-commercial scale unit planning
- Program management

Commercialization

The resultant Catalytic Hot O_2 Reactor (CHOR) pilot project will be evaluated for commercialization. If determined to be commercially viable, technology transfer will occur through publications, worldwide licensing, and sales of this new technology to ethylene plants.

Project Partners

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Praxair
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September 2001